DOCUMENT RESUME

ED 092 373 SE 017 815

AUTHOR LaHart, David E., Ed.; Tillis, C. Richard, Ed.
TITLE Strategies for Multidisciplinary Environmental Education.
INSTITUTION Florida State Dept. of Education, Tallahassee. Div of Elementary and Secondary Education.
PUB DATE [74]
NOTE 78p.; A related document is SE 017 816
AVAILABLE FROM Bureau of Environmental Education, Department of Education, 347 Miles Johnson Building, South Duval Street, Tallahassee, Florida 32304 (free while the supply lasts)

EDRS PRICE MF-$0.75 HC-$4.20 PLUS POSTAGE
DESCRIPTORS *Curriculum; Curriculum Development; *Environmental Education; *Instruction; *Interdisciplinary Approach; Resource Materials; *Secondary Education

ABSTRACT

This volume is a collection of position papers, each of which develops an intellectual framework for teaching a particular subject-matter discipline within an environmental context. The subject matter areas included are political science, health education, language or communication arts, art, science, mathematics, and social studies. (DT)

U.S. DEPARTMENT OF HEALTH
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

ED 092373

# STRATEGIES FOR
# MULTIDISCIPLINARY ENVIRONMENTAL EDUCATION

Edited By

DAVID E. LAHART
and
C. RICHARD TILLIS

DEPARTMENT OF EDUCATION
FLOYD T. CHRISTIAN, COMMISSIONER
Division of Elementary & Secondary Education
Bureau of Environmental Education
Tallahassee, Florida

SE017 815

TABLE OF CONTENTS

Introduction ..... 1

Political Science ..... 2

Health Education ..... 7

Communication Arts ..... 22

Art ..... 29

Science ..... 43

Mathematics ..... 53

Social Studies ..... 63

# INTRODUCTION

The Florida Department of Education commissioned a series of strategy papers to outstanding scholars in specific subject matter areas.

Papers were commissioned with:

John DeGrove for Political Science
Wynn F. Updike for Health Education
Herb Karl for Language or Communication Arts
George Pappas for Art
Lehman Barnes for Science
Ernest Burgess, Jr. for Mathematics
Irene Clark for Social Studies

These persons were asked to develop an intellectual framework for teaching their particular discipline within an environmental context. No specific format or direction was given; each scholar was encouraged to develop his own style and approach to the problem. The following position papers resulted from this effort.

It is hoped that this volume and its companion volume Multidisciplinary Environmental Education Activities will serve as a useful tool in curriculum development projects in Florida and in other states.

# CASE STUDY APPROACH TO ENVIRONMENTAL AND POLITICAL SCIENCE INTER-DISCIPLINARY EDUCATION AT THE SECONDARY LEVEL

by

Dr. John M. DeGrove
George W. Griffith, Jr.

## INTRODUCTION TO STRATEGY PAPER

There are many approaches to the interdisciplining of environmental studies and political science education. Of these methods, the one incorporating environmental case studies is among the best. Case studies bring out the political bargaining and maneuvering that makes the difference between victory and defeat of issues within the political process.

The case study approach also offers a bonus to the educational process. First, in the classroom setting, through a true narrative, the students will study how a real environmental problem is handled by our political process. Then, the students are given an opportunity to attend a local public hearing and, together with their newly acquired background, should be able to identify similar political actors, pressure groups, and political solutions in their real setting. This combination is not only a valuable educational experience but also a mechanism to show students the ability of private citizens to influence the process of decision-making, and to bring about meaningful change within the framework of our institutions.

## I. What is Political Science Education?

As of this writing, the Social Science curricula of elementary and secondary schools contain a heavy emphasis on History and Geography. The teaching of political behavior or political science is almost non-existent. This unfortunate void is being investigated by qualified organizations, one of which is The Division of Education Affairs of the American Political Science Association through a National Science Foundation grant. Because of this effort and others, social science education will probably be changing somewhat in the near future, and, when it does, we must be ready to integrate environmental education with it along the guidelines set by the Division of Environmental Education.

## II. Environment and Political Behavior

It is very hard today to find a body of water whose quality is not threatened nor a metropolitan area that is not suffering from pollutants. At the same time, one seldom encounters elected officials who are willing to go on record in defense of dirty water or polluted air. What is the paradox? The gap between these two situations, the rhetoric in the Congressional Record and the actual conditions of our environment, lies within the realm of politics. The only way that our government will effectively respond to pollution is if the public's concern is translated into action and their words are converted into a financial commitment.

There are three definite reasons why the discipline of political science must be considered when one is considering environmental studies. These are the following:

1) Control of pollution is unavoidably the responsibility of government because of the need for standardization, the adoption and implementation of laws, and the ultimate public and private costs involved.

2) Competition and industrialization encourage pollution because resources like air and water are, at least in part, free and it is too much to expect private and even public concerns to exhibit self control.

3) Defining pollution is an <u>interdisciplinary governmental</u> problem. Since man disturbs, the degree of disturbance must be defined and regulated.

III. <u>Implementing the Case Study Approach</u>

To implement the case study approach, a text of environmental case studies will be used. This text will be utilized by the teacher as practical illustrations and examples of the different theories and ideas that are lectured on in the classroom.

The instructor will then carry their education to that final step of involvement. By selectively choosing those case studies that reflect current active problems within their own local community, the students would then get a chance to attend an actual public hearing in which similar matters were being discussed. These students, with their newly acquired classroom knowledge and their "real life" experience, will be better able to assess political problems and identify each political actor and relationship and thus have obtained added meaningful tools needed to become the citizens that a democratic society needs and demands in order for it to function successfully in the future.

STRATEGY PAPER

Health Education ⟷ Environmental Education

Submitted by:

Wynn F. Updyke
University of Florida

Prepared by:

Bryan C. Smith
Wynn F. Updyke

## PREFACE

For many years health education has been concerned with environmental issues from several different perspectives. Some of the common approaches have been:

1. Helping people to identify and to understand environmental conditions which constitute direct threats to health and well being of individuals and whole populations.

2. Providing people with an understanding of how to cope with threats to personal and community health.

3. Creating an awareness of means available to individual citizens for the improvement of environmental conditions which are detrimental to health.

More recently, health educators have broadened the scope of their objectives to include a strong effort toward stimulating awareness in students of the long term consequences resulting from abuse of the environment.

All of these approaches are important and may even be relatively effective under conditions of extreme crisis. Of course, they are all dependent upon presentation of factual information; in addition, they usually seek to help people comprehend the general concepts underlying the relationships between the environment and human health. Unfortunately, in situations where the threat to health (or survival) is not imminent, such approaches have met with limited success, in terms of any observable changes in behavior. It has become evident that knowledge of facts and understanding of concepts have little effect in modifying behavior if such modification conflicts with practices which are considered important,

pleasurable or otherwise desirable.

In short, one's behavior is based upon his personal values system. Recently, health educators have been giving consideration to the important role played by personal values systems in human behavior.

When a person is helped to give conscious consideration to the things he values most in life, particularly in a non-judgemental setting where others are doing the same thing, it has been observed that behavioral modifications, based upon rational decisions, are more likely to occur than would otherwise be the case.

Because this process seems to help people act with more internal consistency concerning many matters, including health-related practices, a feeling of "wholeness" and well being is fostered in the individual. Thus, the values clarification procedure is, of itself, health education.

The utilization of the valuing process seems particularly appropriate in helping people learn to deal with environmental problems. It will take more than knowledge of facts and understanding of concepts (as important as these are) to enable our society to effectively balance our immediate personal interests against the longer range consequences. The utilization of the valuing process in conjunction with factual and conceptual material, forms the basis of the health education units presented in this document.

# I. HEALTH EDUCATION: WHAT IS IT?

## Evolution of Health Education

Health education has evolved through many forms from the days when Horace Mann, in 1842, urged educators to include health teaching in public schools. This evolution has been a continuous process by means of which health education is now established as an important entity among the subject areas of the curriculum. The goal of health education is not to insure a high level of health simply for health's sake, but to assist people to value health as a quality of living that will help each individual to attain personal goals and to utilize his highest potential for bettering self and community. People are confronted with health related decisions almost daily. They cannot be avoided. Thus, health education is an integral part of general education focusing upon human concerns and values. It offers an effective means of achieving self awareness and actualization enabling people to attain a life style that is healthy and happiness promoting.

Health education is multi-disciplinary in nature. Its content comes from public health and the anthropological, biological, behavioral, and social sciences. Its scope is broad, covering diverse topical areas such as the complexities of drug use, nutrition, radiation, mental health, and human sexuality. Also, included are the community topics of international health problems, accidents, medical care, and environmental concerns. However, health education does not rest on the cognitive alone. It also motivates and helps people to discover alternatives to facilitate decision making. Health education derives its methodology from the behavioral sciences, primarily sociology and humanistic psychology.

New Role of Health Education

The broad scope, diverse methodology and the phenomenal increase in knowledge in each topical area have created a crisis in curriculum development in health education. Because it is no longer possible to cover all the material in genuine learning situations, a redefinition of the role of health knowledge was undertaken and a closer look at the variables which influence health behaviors was begun. Since behavior is influenced less by knowledge than by the concepts and values a person holds, a new thrust in health education was made.

Teaching Strategies

Health education, as with other curricular entities, can be taught on any or all three of the following levels: (1) the facts level, (2) the concepts level, and (3) the values level.

Education at the facts and basic skills level is the foundation of the educational enterprise. It is essential to know and understand the meaning of words and symbols. Without facts we cannot generalize, conceptualize or make abstractions. However, in teaching, facts cannot stand as isolated bits of knowledge to be memorized for an exam, and then discarded. Facts by themselves rarely touch the person or his life in any meaningful way.

Teaching on the concepts level gives students a new dimension of thought. At this level students are encouraged to examine the larger overall ideas into which facts have been integrated. Working independently they acquire concepts at their own speed. They are stimulated to be creative and discover for themselves the meaning of concepts. They test their ideas. Mistakes are accepted and are considered as part of the

process. This practice of concept formation may persist for a lifetime becoming strengthened or modified as new facts are revealed.

Unfortunately, teaching on the concepts level is not sufficient in health education. We once incorrectly assumed that the capability of rational and abstract thought enabled a person to make value decisions. However, we have all witnessed brilliant scholars contribute to the destruction of the environment because they failed to consider the value of what was lost.

To make a difference in the quality of life we cannot remain on the facts or concepts levels of teaching. A third level, that which relates the subject to lives of people, must be entered -- the values level. The purpose of facts and concepts is to give form to values. It is the values we hold that help determine our decisions and behaviors.

Levels of Learning

The process of health education cannot be merely a cognitive exercise. It must touch the lives of students and integrate thinking, feeling and acting that give a sense of purpose to life. It should not impose values on the person, but help him discover relationships for himself. The goal of teaching at all three levels is to help the student discern the facts, incorporate and synthesize them and live by the meanings perceived.

Three Level Teaching

Here is an example of three level teaching: A class is studying Florida's most troublesome single environmental problem--waste disposal (1;68). They examine the facts: What kinds of wastes are there? What methods are used to dispose of them? Which of these methods are damaging the environment? How many adequate facilities are there operating in Florida? Can they handle future growth? What diseases and other health problems can occur from improperly treated wastes? How does this affect

the Florida aquifer? As the students look more closely at the facts, they inevitably make comparison between waste disposal in Florida and other states. The comparisons deepen their understanding of concepts such as commercialism, community responsibility, geography, public health, and ecology. In conducting their own investigations and with the weighing of the evidence, they learn the process of descriptive research. On the values level, students consider the alternatives to currently used methods of waste disposal. They choose positions on the problem and publicly affirm and defend these points of view. They act on their beliefs in an appropriate way. The class has integrated the facts, concepts, and values levels.

## Values Clarification

Most experienced teachers have had experience with working at the levels of fact and concept formation. Relatively few, however, have been exposed to the methodology used at the values level.

Values clarification through group processing does not impose a predetermined set of values. It does use the dynamics of group involvement to help people discover, sort out, talk about, think through and reestablish their own value systems. The emphasis is on the process, the very personal process by which an individual defines his own value system and by which he makes decisions.

Valuing is a personal process that goes on within and between individuals at different rates, in different ways. If students are involved in a pencil-paper exercise in which they probe their own thoughts and feelings in relation to various positions they have taken on the environment, and are not ready to make a public affirmation of this position, they should have the right to privacy. They can express this right by passing. At any point in group processing a person has the privilege of passing which, in effect, is saying, "I prefer

not to commit myself yet," or "I don't know," or "I'm not ready to share my ideas." Respecting privacy and confidences is not only an ethical responsibility but also a necessary one if the experiences are to be worthwhile.

Small groups of four to eight people are used to facilitate self-disclosure through trust, openness, and interrelatedness that personally develops out of group interaction. Each group member must have the freedom to move at his own rate or respond differently from his peers. This helps people to arrive at their own personal decisions rather than just accepting those imposed by a peer group or power figure.

Each group activity follows a similar developmental sequences or series of steps:

(1) The first step is to open up the topical area and the people's thoughts about it, to get information out, to stimulate thought about other value-related things, to make a response, and to share responses with others. Questions which are asked of the group are open-ended. There are no right, wrong, or predetermined answers.

(2) The second step is to accept the feelings, concepts and actions of other people without judging them. Acceptance means that it is safe to be open and honest with others and with the self no matter how confused or negative the message might be. In the group there are no judges or juries, no analysts, no policemen, no winners, no losers. At any point anyone can pass.

(3) The third step is to stimulate thinking, to think more about the position taken or a decision tentatively made, so that he is gently pushed to clarify the value he is in the process of realizing.

(4) The fourth and final step is acceptance of the response whatever it is, here-and-now.

Why is it that any expression of values, any open evaluative stand on an issue, any judgement about anything is countered with "that's a value judgement?" The idea is put down as somehow being undesirable. There is a big difference between expressing values and imposing values. The time has come to examine the whole concept of identifying, clarifying, and expressing values.

Valuing* includes seven elements clustered in the three action process of choosing, prizing, and acting. These seven elements can be used as a set of criteria in determining the nature or depth of any value commitment.

| | |
|---|---|
| CHOOSING | 1. Choosing from alternatives<br>2. Choosing after considering the consequences<br>3. Choosing freely |
| PRIZING | 4. Considering what one prizes and cherishes<br>5. Affirming one's choice publicly |
| ACTING | 6. Doing something, acting on the choice<br>7. Acting repeatedly as a pattern in life |

Although each group activity usually emphasizes one or two of the three action processes, each can be stretched to include all three. The goal of using these activities is to help people look at alternate ways of handling problems or situations, examine the consequences for each alternative, and make personal decisions based on information they have generated. By emphasizing the prizing and acting processes, value clarification brings immediacy and meaning to the decisions people make for themselves.

The unique quality of the affective approach is that the process

---

*See Raths, Harmin, and Simon, Values and Teaching, Columbus: C. E. Merrill Books, Inc., 1966.

used in the group is a model for the valuing process itself. Some of the values that man tries to satisfy in the real world emerge as a product of the group process. As group activities progress the characteristics of happiness, love, power, and trust usually unfold and reveal themselves.

## II. HEALTH EDUCATION ⟷ ENVIRONMENTAL EDUCATION RELATIONSHIPS

### Descriptive Analysis

In the past fifty years, man has experienced tremendous changes in his environment. Some have been beneficial to his health including his social and economic well-being. He has looked at these "gains" from a wholly selfish point of view, however, and has failed to measure them as ecologic assets or liabilities.

Many problems brought about by manipulation of the environment have been measured only in terms of damage or threat to man's life. Prevention of these problems was dependent upon a better understanding of the conditions leading up to the problem. To meet this need a new kind of science was developed -- epidemiology. Since the time of Hippocrates, epidemiologic methods have been used in an attempt to discover the causes of human disease. To be able to accomplish this task the epidemiologist developed the concept of the agent-host-environment chain. All problems of human disease depended upon the chain of these three factors which could be disrupted by unhinging any one link of the chain. The environment was and is considered a vital part of solving community health problems.

### Some Examples

In contrast with medical practice, which has an individual as its focus, epidemiology is concerned with the population or group as a unit

of study. It was originally applied to the study of communicable disease, but the methods were modified to accomodate a host of non-communicable illnesses and community problems. This modification included a shift from observing the well-defined cases -- those who were sick and those who were not sick -- to observing broader human problems and concerns. To illustrate this two examples are appropriate:

(a) John Snow's (2) investigation of cholera in London in 1854 is a classic example of observing defined cases. Snow noted that two-thirds of the population living south of the Thames was served by two water companies. One of these companies had its water intake in a grossly polluted part of the Thames; the other was in a far less polluted section. These were competing companies serving the same areas and streets. Some houses on the same street purchased water from one company and some from the other. Snow determined the source of water supplied to each house in which a death from cholera had occurred during the first part of the epidemic and tabulated attack rates. He was able to show the relationship between cholera mortality and the consumption of polluted water.

This work by Snow was conducted prior to the establishment of the germ theory of disease. Since the miasmic theory was accepted at that time, Snow's findings were rejected.

(b) On the morning of October 26, 1948, at Donora, Pennsylvania, the skies delivered a deadly warning that man had poisoned them beyond endurance. A temperature inversion pushed down a heavy fog which blanketed the bleak and grimy town. It hung suspended in the stagnant air while local businesses -- steel mills, a wire factory, zinc and coke plants -- continued to spew waste gases. Within 48 hours, visibility had become so bad that residents had difficulty finding their way home.

Donora's medical community was besieged by coughing, wheezing patients complaining of a wide variety of respiratory ailments. During the next four days, before a heavy rain washed away the menacing shroud, 5,910 of the town's 14,000 residents had become ill. Twenty people and an unknown number of household pets had died.

Donora shocked the public into an awareness of the threat posed by an industrialized, pollutant producing society. Heinmann, et al. (3) described follow-up epidemiological studies that not only showed the causal relationship of those who suffered from illnesses during the acute air pollution episode, but also the same etiology with subsequent illness histories occurring within the next ten year period.

The potential of epidemiology has barely been tapped. In recent years it has been used to understand the cause and effect relationships of many environmental problems posing threats to man's health. The agent-host-environment chain utilizes the environment as an integral part of the epidemiological model. In this sense health education and environment education have a reciprocal relationship.

## Values and the Quality of Life

Where are we going? What's it going to be like when we arrive? Who am I?

Quality of life? Where do we start? With a two year old car that's dead or a dollar that's worth less each year? Or a lake too dirty to touch or the Bank Americard statement you can't understand or the computer you can't fight or insult, or the traffic that burns you and your car up? Or the generational guilt toward both the young who are too far away and the

old who are put away? Or "progress" that is too fast or too slow or just right for no one? Or the unspoken feeling that life is cheating us or only the other guy gets ahead? What ever happened to simple non-political, non-hate-filled, non-issue-oriented, non-crisis-connected communication?

The standard of living rises while the satisfaction of living declines. Planes are faster, cars are faster, but we have fewer unspoiled places to go and more people who want to go there. As President Nixon in his inaugural address said, "We are rich in goods but ragged in spirit." Earlier another president, by the name of Lincoln, said, "If we could first know where we are and whither we are tending, we could better judge what to do, and how to do it."

What do we value and what constitutes the quality of life? Both health education and environmental education share this challenge. Values have been extremely important constructs in the development of the environmental crisis. They are also important to the environmental solution.

Will people be willing to make changes, to make the sacrifices necessary to achieve a society which maintains a high quality of life but does not destory the environment? The value system of most people places many things above the environment. Each person has his own set of values and ranks them in order of importance. He makes decisions on the basis of these priorities. We need to re-evaluate our values concerning material objects, on growth, on individual self reliance, on profits, and on other measures of economic gain. Most values systems that support these have very slowly evolved over hundreds of years.

Change is slow when values are challenged. The average person can tolerate only a slow, orderly modification. Most changes in values occur

between generations, over about twenty-five years. A child makes slight changes in those values of his parents. The "generation gap" appears when the child's values are dramatically divergent from the parents'. In the past it has taken about three generations to achieve a value change that reflects a national attitude. How long will it take to change attitudes toward materialism, success, individualism, or competition? Can the values system be changed soon enough to save what is left?

The quality of life -- what will it be like? That's a reciprocal and shared challenge to environmental and health education.

1. Rackleff, Robert. Close to Crisis. Tallahassee: New Issues Press, 1972, pp. 158.

2. Snow, J. On the Mode of Communication of Cholera. London: Churchill, 1855, (Reprinted in Snow on Cholera, New York: The Commonwealth Company, 1936).

3. Heinmann, H., L. O. Emik, R. A. Prirdle and W. M. Fisher. "Progress in Medical Research on Air Pollution," Public Health Reports 73:1055-1068, December 1968.

# INTERDISCIPLINARY ENVIRONMENTAL EDUCATION:

# THE LANGUAGE OR COMMUNICATIVE ARTS

# POINT OF VIEW

Herb Karl
Communication Education
University of South Florida
Tampa, Florida

# INTERDISCIPLINARY ENVIRONMENTAL EDUCATION: THE LANGUAGE OR COMMUNICATIVE ARTS POINT OF VIEW

Susanne Langer, one of America's most respected philosophers, has spent most of her professional life trying to explain the difference between communication as a science and communication as an art. She speaks on the one hand of the discursive (or scientific) function of communication--language that is intended to communicate thoughts rationally and directly. (I am attempting to be discursive at this moment.) And she speaks of the non-discursive (or artistic) function of communication--language which tends to communicate thoughts emotionally and indirectly. Both functions are symbolic--discursive tending to be more objective, giving clarity to external reality, non-discursive tending to be more subjective, giving a sense of inner experience, what Langer calls "the life of feeling and emotion."

My purpose in introducing Miss Langer's explanation of discursive and non-discursive communication functions is to encourage the reader to think of communication (verbal or other) as something which can affect human attitudes, commitments and actions in two significantly different ways--through rational argument and/or through emotional appeal.

In his book Teaching for Survival (a handbook for environmental education), Mark Terry suggests that the communication functions, especially the non-discursive, could contribute vitally to improving the

quality of life on this planet; but, at present, he sees the "skills of abstraction, imagination, and communication no longer so clearly directed toward a common goal." If Terry is correct in his assumptions, an environmental education program which attempts to integrate the communicative arts must attend to both functions (discursive and non-discursive), making each relevant to a common goal: the appreciation of the environment as a life support system which can be destroyed by unthinking and unfeeling man.

The strategy I'm about to introduce for integrating the communicative arts into a total environmental education program requires, first of all, an understanding of the forms and functions of communication I've attempted to outline in the preceding paragraphs. Before I present this strategy, let me make two more points, the first of which was inspired by the paragraph which appears on the bottom of page 27 in the Florida Master Plan and Action Guide for Environmental Education. It reads: "Words suffice in a world of words, but fail in a world of things. Environmental Education deals with things, outdoor things, and as such it must include outdoor activities." Like almost everything else that has been put into "words," this quotation can be argued to be both true and false--depending on how you look at it. It's true, because the environment is about things--things that can be observed like trees, rivers, oceans, people and other animal life, air, smog, soot, noise, waste, and various other organic and inorganic substances. The sciences--both natural and physical--offer us a way of observing these substances, of measuring or quantifying them and of understanding their inter-relationships within an environment, either natural or man-made. The statement is false, because the environment--its present value and future potential--must be communicated (whether in words or other forms of

communication) to human beings, if they are to act to protect and preserve it for present and future generations. The words of Rachael Carson communicated a message which ultimately resulted in a more careful examination of the use of DDT. The words of Paul Ehrlich helped to focus attention on population growth. And perhaps, in a non-discursive way, the recent film "Soylent Green" may have caused some of its viewers to re-examine their own feelings about the kind of life they want their children to enjoy at some point in the non-to-distant future. Of course, the meaning of this passage is actually much less complicated than I've made it. It's intended to emphasize the importance of having students in an environmental education program get out from behind their textbooks and experience the natural environment first-hand--a strategy which many educators have endorsed for some time.

This brings me to my second point. If, as the passage I quoted suggests, the environment is about "things" and if we can view the communicative arts as having certain functions and forms, then a strategy for integrating the communicative arts into an environmental education program suggests itself.

The strategy is based on the following assumptions:

1. The sciences (natural and physical) offer the student a vocabulary of the environment (ecosystem, recycling, pollution, demography, etc.) and a way of relating the parts of an environment to the whole.
2. Mathematics offers the student a way of quantifying the elements of an environment and of determining the measurable changes that take place within an environment.

3. The social sciences offer the student an opportunity to study the way man has altered or accommodated himself to his environment in order to satisfy his needs or dreams.
4. The communicative arts (including the "fine"arts) offer the student a way of recording and transmitting his perceptions of the environment--how it appears in the present, what it might have been like in the past, or what it might become in the future.

Proceeding from this set of assumptions, the development of an inter-disciplinary environmental education program would mean pooling the expertise available from each of the disciplines. Conceivably, there could be some "focus" instructional units or sequences of activities where a particular approach might be emphasized. In the communicative arts, for example, an elementary sequence might ask children to record (journalistically or artistically) their perceptions of certain environmental matters: pollution, endangered species, or urban sprawl; at the secondary level, students might be asked to calculate the effects of mass communications (e.g., TV, radio, magazine, and newspaper advertising) on environmental issues. Whether the instructional sequences are totally interdisciplinary or whether there might be an attempt to "focus" attention on a particular discipline, I am convinced of the necessity that such instruction be a result of the sharing of knowledge and instructional methodology possessed by each of these disciplines.

In the chart below, I have attempted very briefly to outline the kinds of communicative arts activities which might be featured in various kinds of interdisciplinary environment-centered instructional sequences. Following the chart are two partially developed units of study which "focus" on the language or communicative arts.

| KIND OF UNIT OR SEQUENCE OF ACTIVITIES | LEVEL | ACTIVITIES | |
|---|---|---|---|
| | | DISCURSIVE | NON-DISCURSIVE |
| 1. Study of endangered species. | Elementary | Student tries to discover as much information as he can about a particular endangered species. He prepares a dossier on the animal, pastes pictures, writes or dictates a history of the animal. | Student invents an imaginary endangered species, draws its picture, tells or writes of its demise, etc. |
| | | Class prepares a book containing dossiers and mounted pictures of various endangered species, real and imaginary. | |
| | | Class writes and enacts an original play about endangered species, featuring real and imaginary animals. | |
| 2. Study of pollution featuring a field trip in which some local problem is observed by children. | Elementary | Children keep journals of field trip, recording their observations; or they photograph the setting in order to prepare a photo essay of the trip. | Children compose creative responses to situation (verse, short narratives, montages, etc.). |
| | | Children write letters to local officials or environmental experts, expressing concern over the conditions and questioning what might be done to change the situation. | |
| | | Class prepares newsmagazine containing picture essays, journal entries, letters, and other creative pieces (all dealing with local problem or pollution generally). | |

| KIND OF UNIT OR SEQUENCE OF ACTIVITIES | LEVEL | ACTIVITIES | |
|---|---|---|---|
| | | DISCURSIVE | NON-DISCURSIVE |
| 3. Study of the affects of advertising on shaping attitudes and behavior toward the environment. | Secondary | Student prepares a folder of ads which might contribute to environmental damage (directly or indirectly).<br><br>Students write letters to corporate heads, telling of the ill effect their company's advertising might be having on the preservation of the environment.<br><br>Students prepare an advertising campaign (resorting to the persuasive techniques of an ad man, using all media) which attempts to reveal the potential ills of national advertising. The campaign could be presented to the public. | Students prepare an original counter-ad (printed, illustrated, taped, filmed, etc.) designed to alert the public to the environmental ills which can be attributed to a particular company's products or services. |
| 4. Study of unplanned development of local land. | | Students prepare an ecological survey of a local land area due to be developed, including water, soil, plant, and wildlife analysis. | Students design and construct a model of the kind of development which would be feasible in such an area, including homes, businesses, parks, and recreation areas. |

# INTERDISCIPLINARY ENVIRONMENTAL EDUCATION:
# ARTS EDUCATION PROGRAM OF INSTRUCTION

GEORGE PAPPAS

ART DEPARTMENT

UNIVERSITY OF SOUTH FLORIDA

TAMPA, FLORIDA

TABLE OF CONTENTS

I. The Senses and their Relationship to Learning

II. Self-Expression and Creativity

III. The Environmental Ethic

IV. Arts Education and the Environment

## I. THE SENSES AND THEIR RELATIONSHIP TO LEARNING

"It is only through the senses that learning can take place. This may seem like an obvious statement; however, its implications seem to be lost in our educational system. It may be that education merely reflects the changes in our society, for man seems to be relying less and less on actual sensory contact with his environment. He is becoming a passive viewer of his culture rather than an active maker of it. Football games are to be watched, not played. Music has become a soothing background syrup in the shopping center rather than a means of actual involvement. The television has become a mass means of distraction in which the viewer's only involvement is that of turning the "on" or "off" switch. Even groceries come packaged in their own sterile plastic containers, removed not only from touch but also from smell."

Viktor Lowenfeld/W. Lambert Brittain

Creative and Mental Growth

The schools must assume the responsibility of making people aware of these senses and their ability to use them. Although some school programs involve students in a number of activities which include movement, manipulation, seeing, touching, and critical hearing, most of these activities are taught as ends in themselves. The purpose seems to be to develop particular skills rather than the utilization of these skills for further exploration and individual creative expression.

A first grade teacher may be pleased to see he or she has helped a youngster in acquiring the skill of manipulating scissors or clay. These skills are observed and can even be measured. However, the limitless possibilities of using the scissors or clay in a creative way are then usually never explored.

Touching, seeing, hearing, smelling and tasting involve the active participation of the individual. Very young children engage in all of these activities in an intuitive manner. As a child grows our society begins to put more and more restrictions on his need to continue his sensory development. The pressures of "don't touch", "it's bad for you to see that" or "don't put that in your mouth" seem to multiply and inhibit further natural exploration. It is then important that in later years the development of refined sensory activities be a continuing process, with education contributing the greatest opportunity for this development. The arts are filled with opportunities for children to develop their senses. The direct involvement with color, textures, shapes as well as auditory experiences in detailed listening and the kinetics of dance will make an individual more aware of a relationship between himself, others and his environment.

## II. SELF-EXPRESSION AND CREATIVITY

Self-expression of the individual becomes of major concern in teaching the arts. To help children individually respond to the environment through personal feelings, emotions, and thoughts should become the goal of all teachers. In this involvement the role of the teacher becomes critical. Self-expression has sometimes been misinterpreted as a license

that allows children to do whatever they please; without structure or supervision. The teacher, to the contrary, assumes the important responsibility of developing a structure and an atmosphere in the classroom where flexible attitudes towards the arts are developed and where creative self-expression can flourish. Individual efforts related to the child's intellectual, emotional and artistic level are promoted and encouraged.

The most single danger in teaching the arts is allowing children to continually imitate or rely on others for their thoughts and ideas. The mass of coloring books, mimeographed sheets, paint by numbers kits and dictated activities develop a dependency in children that inhibits their potential for expression. Because the imitative child cannot give expression to his own thoughts his dependency on others begins to grow and he may become incapable of participation in art without dictated instructions or examples to copy. This may lead to inhibition of personal ideas and the dependency on stereotype solutions or the common cry of "I can't draw" or "I don't know what to do". It is the individual who is free from these kinds of inhibitions that can function as a creative thinker. Since the Arts have the potential to allow children to be involved in creative decision making, their experiences in turn will have a positive effect on their approach to problems in other areas and their attitude toward creative life situations. The importance of stimulating creative thought can be appreciated through these statements by outstanding educators.

> "Creativity is the ability to invent new symbols and ideas, to improvise on established symbols, to rearrange established organizations into new organizations, and to

integrate new or borrowed ideas into previously organized systems or situations."

June King McFee

"Creativity is an instinct which all people possess, an instinct with which we were born. It is the instinct which we primarily use to solve and express life's problems...creativity, the ability to explore and investigate, belongs to one of the basic drives, a drive without which man cannot exist."

Vicktor Lowenfeld

"Creativity requires freedom -- freedom to rebel against stifling conditions, freedom to make decisions differing from those made yesterday and differing from those made by others -- but it is not unlimited freedom."

Alice Miel

"Creative learners learn by questioning, inquiring, searching, manipulating, experimenting, even playing around, but always tring to find out the truth."

E. Paul Torrance

"...creative thinkers are flexible thinkers. They readily desert old ways of thinking and strike out

in new directions...in the area of creativity one should certainly expect to find a trait of originality."

J. P. Guilford

"My definition, then, of the creative process is that it is the emergence in action of a novel relational product, growing out of the uniqueness of the individual on the one hand, and the materials, events, people, or circumstances of his life on the other."

Carl R. Rogers

Thus, the inclusion of a strong program in the arts will play a major role in helping children develop a feeling of individual identification and actual participation in creative experiences related to their environment.

"Fundamentally, what we need is an entire generation sensitive to these (environmental) issues. This is a new mission for education. A whole new profession of creative people must be fashioned who are committed to enhancing our environment for the sake of the health, the minds, and the hearts of our people. It is a thrilling challenge and a life-calling worthy of the best talent our nation has at its command. Perhaps, it will become one of the highest forms of art."

Walter J. Hickel

## III. THE ENVIRONMENTAL ETHIC

The condition of man's environment must become the concern and responsibility of everyone. Our total neglect of the quality of our water and air, our misuse of natural resources, our contempt for the survival of other species, the numbing of our aesthetic sensitivities, and a value system which places the advancement of technology above all else, cannot continue without devastating results.

It is obvious the task is so complex and large that no single group or agency has the capacity to solve the problem alone. It is a responsibility that must be felt and established beyond the limited range of government agencies, social clubs, or citizens groups.

It is only when every member of the human community feels a personal identity with his environment and a need to preserve, protect, and develop it for himself and others that a course of effective action can be taken. This means a sincere individual environmental ethic has to be felt by all people.

Perhaps those who are in the best position to help people develop personal, sensitive identities with these problems are our nation's teachers. The potential for developing new learning experiences related to the environmental ethic is limitless. It becomes a "common" area of study which cannot be taught or experienced through past approaches of distinct and separate disciplines. Traditionally, the study in subject areas such as math, literature, art, and geography has been somewhat limited in scope.

Since a single area of study cannot adequately explore the relationship of man to his environment, it is necessary for the encouragement of an environmental ethic to have all subject areas conjoin in looking at today's man in an attempt to understand where he lives, how he lives, and subsequently how he will live in the future.

Although this paper deals primarily with suggestions for a curriculum in arts and humanities and the environment, it must be considered in relationship to other curriculae being proposed.

## ARTS EDUCATION AND THE ENVIRONMENT

Teachers of the humanities have long been concerned with the individual's identification with his environment. This identification has been established through the development of an understanding and respect for materials, a sharpening of the senses, the translation of the beauty of natural and man-made images onto canvas, paper, film, music, etc...and the construction of controlled environments in theatre, dance, concerts, and happenings.

Before a focus on curriculum can be established, it is necessary that there be an understanding and a commitment to environmental education. This can probably be accomplished best by a series of comprehensive in-service teacher education programs presented at the beginning or throughout the school year. These series of experiences are designed to help teachers increase their understanding and interest, and develop technical skills that would help them become involved in the complete process of curriculum development most suitable to their students, school and community.

## IN-SERVICE EDUCATIONAL PROGRAMS FOR TEACHERS

The special in-service educational programs for teachers would involve a series of workshop experiences related to the social, physical and cultural world in which we live. Four workshop sessions are suggested as follows:

### PROGRAM WORKSHOP #1
### ENCOUNTERING THE ENVIRONMENTAL ETHIC

Over the years man has unfortunately become alienated from himself, others and nature. This workshop session would deal primarily with group process interaction in which the participants would develop an open and flexible attitude towards themselves, each other and the environment.

Group process experts, guest lecturers, films and discussions would be utilized in a workshop of this type. The question to be considered is: How can the individual develop an attitude of responsibility and empathy towards himself, others and the environment?

### PROGRAM WORKSHOP #2
### LOOKING AT OUR TOTAL ENVIRONMENT

A broad understanding of the total environment, both man-made and natural, in which we live. An attempt will be made to help the participants more fully understand the nature of the total Florida environment. Films, field trips and visiting lecturers will present information related to weather, natural resources, population, urban and rural areas, tourism,

etc... The question to be considered is: What is the real character of the state in which we reside?

PROGRAM WORKSHOP #3

THE INDIVIDUAL'S RELATIONSHIP TO THE ENVIRONMENT

A personal insight into how each workshop participant relates to his personal environment. Some questions to be considered are: What are the unique characteristics of your personal environment? How do you relate to your environment (your room, your home, your school and city)? How do you relate to others in your participating group? What are the similarities and differences?

Participants could take films, photos, draw or write about their own particular environment or life style.

PROGRAM WORKSHOP #4

PROBLEMS OF THE ENVIRONMENT

Isolation of specific problems related to the immediate environment with discussions of solutions. The questions to be considered are: What are the major environmental problems of your particular area? What are the citizen's groups, local and federal agencies that can be of assistance? How can the development of a curriculum in environmental education be related to these specific problems?

After the workshop experiences the teachers should have a much better attitude towards the problems of the environment and the possibilities of solving them. Any proposed curriculum should be flexible enough to be easily changed and integrated with other areas.

# SCIENCE AND ENVIRONMENTAL EDUCATION

## A Strategy Paper

Lehman Barnes and George Dawson
Florida State University
Tallahassee, Florida
November, 1973

# SCIENCE AND ENVIRONMENTAL EDUCATION

## A Strategy Paper

What is science? In a recent conversation with several sixth and seventh graders, we received a variety of responses when we asked these young people to define science. Some suggested that science is the information you find in science books, others remarked that science is "what scientists do", such as experimenting, or investigating, or studying nature. A few students used the term environment in their definition of science. There was concern with "how does a scientist make up knowledge about the environment?" or "just what does a scientist do when he investigates the environment?". As we were ending our get together with these youngsters, one of the students offered this question: "Can you do science outdoors?" That is one question people of all ages ask and the one to which this paper addresses itself.

An environmentalist finds himself in a unique position. He teaches in a setting that has built-in interest. People in general are attracted to the out-of-doors. Practically any subject can be made meaningful in this setting. People have been inspired for ages by being in the out-of-doors. Loren Eiseley, in his book *The Immense Journey*, stated that "the man seeking visions and insight must go apart from his fellows and live for a time in the wilderness." So not only does the environmentalist have a classroom -- the great out-of-doors -- that can make most subject areas quite meaningful, but that classroom can serve even as a source of inspiration. This is especially true for the teaching of science. To the young, and unfortunately often to adults, the interworkings of a cell, the manipulations of molecules and atoms, and the movement of continents, hold little interest. But speak to someone about our environment and you usually get their attention.

Science is not, however, a simple walk through the woods. It is not just lying on your back near a pond just watching beavers or muskrats at work. Nor is it the mere collection of data. Percy Bridgeman gave it a classic definition when he stated that "science is doing one's damndest with one's mind." That definition defines science in its very broadest terms. J. Stanley Marshall perhaps gave it a little more focus when he stated that "science is the meaningful interrogation of nature." That implies that we subject nature to questions -- questions to which we hope to get answers. To answer some of these questions, an environmentalist may say that we need to apply "the scientific method." This is a very egotistical approach for a scientist. Since these questions fit many other disciplines, many subject areas other than the sciences have questions that can be answered using the same methods. This method, simply stated, says that we have to recognize the problem as a problem, collect background information, formulate a hypothesis, do a controlled investigation, interpret the data, and make decisions based on those interpretations.

The scientific method is a technique to interrogate nature. But what is the subject matter? It is felt by some people that a study of all the sciences can be reduced to a study of eight themes. These themes are as follows.

(1) There is a continual interaction between objects and their environment, the environment affects the object, and the object affects the environment.

(2) There is a dynamic equilibrium throughout the universe. Solar systems may come and go, continents may disappear and others appear, populations may decrease for a period and then increase, all fluctuating around some norm.

(3) There is a large variety of objects but patterns can be found in this variety.

(4) Things change through time.

(5) Science is the process of seeking. It is always changing as new knowledge is found.

(6) Our present understanding of our universe is the result of a long history of observation and experimentation. Many people of many nations have contributed to the building of this understanding.

(7) Knowledge awaits instrumentation.

(8) All things in the present have a continuity with things of the past.

Some of the disciplines of science seem to fall more into one of these thematic areas than another. For example, theme number one -- the interaction between objects and their environment and vice versa -- can be argued to be the dominant domain for physics and chemistry. Likewise, a study of geology can be built around themes three and four. Examination and consideration of these themes will reveal, however, that no discipline can claim exclusively any theme. The sciences are interdependent.

Both biologists and physicists can teach their subject matter around theme number one. For instance, the temperature of the air surrounding a tree affects the photosynthetic rate of the tree. On a cool day that rate is generally less than on a warm day. The trees, in turn, affect the temperature of the air. We are all aware of how there is a temperature drop when we enter a forest after coming directly from the city.

The physicists could use the illustration of the energy of flowing water turning a water wheel. The turning wheel grinds corn and, in the grinding process, the friction of moving parts heats up the surrounding air. All of this energy exchange can be measured. Thus, each of the disciplines of science contribute to an expansion of the thematic idea. Since environmental science includes all the disciplines of science, differences between the sciences become artificial and seemingly contrived. Environmental education, including more disciplines than just the sciences, has gone a step further and removed some of the barriers that have long separated the sciences from the other disciplines, such as economics, art, communications and social studies.

We have suggested that science can be viewed as a study of eight fundamental themes. Let us return to the question mentioned earlier by our sixth and seventh graders, "Just what does a scientist or a seventh grader do when he investigates the environment?". There are a number of skills which one must personally develop and employ in order to scientifically study the environment or, for that matter, to scientifically study anything. Some of the necessary skills are:

(1) *observing* - using one or more of the senses to make statements about a property that can be identified

(2) *inferring* - generating an idea or explanation based on one's observations

(3) *measuring* - describing objects quantitatively

(4) *classifying* - describing and naming properties of an object in order to group the object with, or distinguish it from similar objects

(5) *predicting* - extending an observation or observations to incorporate other observations; making guesses about the same kinds of observations

(6) *hypothesizing* - making a generalized statement about a set of observations or a set of inferences which can be tested

(7) *defining operationally* - defining an object in terms of "how do we know when we have some of a substance and how do we know how much of it we have."

(8) *controlling variable* - recognizing and holding constant a number of variables in an investigation so that a specific variable or variables may be manipulated

(9) *interpreting data* - includes basic activities such as recording, graphing, tabulating and describing data, and higher order activities such as making inferences and constructing new hypotheses

(10) *experimenting* - integrating the many skills mentioned above by formulating hypotheses, testing hypotheses, collecting and describing data related to hypothesis testing and formulating new hypotheses

(11) *model building* - developing of mental models or abstractions which attempt to relate objects and events; using one's reason and imagination to construct explanations of phenomena

We have identified some of the fundamental science skills necessary to the task of asking questions of the environment. And we have suggested eight important themes of science. How, then, does the environmentalist teach these themes of science? How does he/she provide opportunities for young people to acquire and use these fundamental skills of science? An exemplary study can serve as a model of how an environmentalist would use the out-of-doors to teach the themes and apply the skills of science. This illustrative study will be described as if it were being planned for secondary students, but it could be adapted for an elementary student setting.

[Photograph of stream choked with Water Hyacinth]

A Sample Study

We here in Florida often hear of the detrimental effects of the Water Hyacinth. Let's assume that a group of students decided to find out just what the role of the Water Hyacinth is in an ecosystem. One of the first things they would need to do would be to define their terms. It won't take much reading to find out that a population is considered to be a group of interacting organisms of the same species. Another term they have heard much about is a biological community. Such a community is made up of two or more interacting populations. Therefore, a clump of Water Hyacinths near the school could be considered a biological community since the Water Hyacinth has many other kinds of organisms either attached to it or living in and among it. But to study precisely the contributions that the Water Hyacinth may make to its surroundings, they must consider the abiotic (non-living) environment. What effect do Water Hyacinths have on nutrients of the surrounding water? Does the Water Hyacinth contribute significantly to the amount of oxygen in the air? These are just two such questions. When the abiotic influences are considered in a study of a biological community, we then speak of a community as being an ecosystem. Once the background information is given, perhaps the teacher of such an environmental education class can simply raise the questions from which students could choose those that interest them. In answering these questions all the disciplines of science have to be sought for background information. And the knowledge gained in those other disciplines must be applied to answering the questions that the teacher may have raised. In turn, we build upon those eight themes of science, thereby learning science by doing and we have to apply the skills of science mentioned previously; skills such as observing, measuring,

inferring, and hypothesizing. In answering any question, all of the themes might potentially be included in a study. A few questions, the theme upon which they might focus and a few of the scientific skills needed to answer that question are as follows:

1. What organisms live in and around the cluster of Water Hyacinths?

   Theme: number two and three

   Science skills: observing and classifying

2. Do the numbers and kinds of organisms in this ecosystem change?

   Theme: number two

   Science skills: observing and classifying

3. What nutrients and other substances does the plant need and contribute to the ecosystem?

   Theme: number one

   Science skills: formulating hypotheses, experimenting, interpreting data, defining operationally

4. What is the reproduction rate of the Water Hyacinth?

   Theme: number eight

   Science skills: observing and measuring

5. In what water temperatures do Water Hyacinths grow best?

   Theme: number six

   Science skills: controlling variables, formulating hypotheses, interpreting data, hypothesizing, experimenting

6. What wavelengths of light do these plants optimally respond?

   Theme: number one

   Science skills: formulating hypotheses, interpreting data, experimenting, controlling variables

It can be seen that in trying to answer such questions almost all of these themes are taught and in any search for answers, nearly all the scientific skills are used.

Any number of similar problems and questions can be raised by an environmentalist. And when answers to problems are sought by students, they can experience science.

Some of those questions of concern today in our State are as follows:

1. What is the effect of silt runoff into a nearby stream on the populations of fish?
2. What are the long-term effects of adding high temperature water into a bay?
3. What effect does an oil spill have on the marshland?
4. What contribution to the economy of the State does an acre of marshland make?
5. Is Spanish moss of any value to the tree on which it rests?

Environmental education can do so much to make science interesting to all of our students by giving them opportunities to determine and learn how all objects of the earth are interdependent. A major role of the environmental educator is to help students understand what happens when one segment of the environment is manipulated or eliminated. Some teachers are focusing on problems that are facing us today, and good science is being taught and useful science skills learned. By addressing our environmental problems the teacher has an opportunity to place science in a more meaningful context than ever before.

# INTERDISCIPLINARY ENVIRONMENTAL EDUCATION: THE ROLE OF MATHEMATICS

Ernest E. Burgess, Jr.
College of Education
Florida Atlantic University
Boca Raton, Florida

Florida has, through the coordinated efforts of the Advisory Committee on Environmental Education and the Environmental Education Consultant of The Florida State Department of Education, initiated a comprehensive and ambitious program in environmental education.

The Florida Master Plan and Action Guide for Environmental Education specifies a philosophy, goals and objectives, and an action oriented timetable for implementing a coordinated interdisciplinary approach which will stress the development of appropriate attitudes and the processes of inquiry and problem solving rather than merely being limited to the acquisition of facts. One of the important preliminary steps in developing curriculum and in the training of preservice and inservice teachers is to establish a philosophical base for each of the separate disciplines which mediates its integration into the curriculum without compromising the integrity of either the discipline or its practioners. This is particularly crucial in obtaining the whole hearted and enthusiastic cooperation of secondary level teachers who tend to be more discipline oriented than their elementary level colleagues. In particular, mathematics teachers are uni-

quely able to develop their field almost completely without relation to the other arts and sciences.

Although this practice is not consistent with the broad goals of education or with recommended pedagogical strategy it is often the case. This paper is a statement of a philosophy which embraces a more pragmatic view of mathematics teaching and coincidentally an emphasis on the duality possible between mathematics education and the environmental crisis created by modern society.

Bertrand Russell is often quoted as having said "Mathematics may be defined as the subject in which we never know what we are talking about, nor whether what we are saying is true". Regardless of the accuracy of the quotation, it does present a rather startling, but appropriate, comment on the philosophical nature of mathematics. It refers to the basic abstract nature of mathematical entities, such as numbers, which are mental constructs, or concepts, rather than tangible physical objects, and to mathematical reasoning, which is based on the assumptions and principles of Aristotelian logic, rather than empirical experiences.

To appreciate the role

of mathematics in environmental education or in any other application ot the discipline in modern life, one must first understand the nature of the beast. Unlike other disciplines such as chemistry, physics, biology, etc., often classified under the broad heading of "sciences", it is not a phenomina of nature. The usual techniques of the scientist--observation, classification, measurement, and empirically based reasoning--often called "the Scientific Method", do not apply in the generation of mathematical thought. Mathematics exists entirely through the intellectual efforts of mankind, and is totally independent of nature.

A mathematical structure, in its pure state, is the creative effort of the intellect of one or more mathematicians. It is formed, organized, and validated using only the principles of Aristotelian logic and other pre-existing mathematical structures as tools and yardsticks. The completed structure stands on its own merits, as does any creative endeavor, without any necessary relationship to the physical universe. The mathematician's primary concern is with the internal consistency of his

structure, rather than the applicability or practicality of it with respect to other disciplines. In spite of this rather narrow philosophical basis--or perhaps because of it--mathematics is potentially the most applicable of all the intellectual constructs of man to the physical environment in which he exists. It offers the scientist, the engineer, and the researcher a readily available abstract model in which to test, conveniently, his hypotheses, conclusions, and projections. For this reason mathematics is often thought of as a "tool subject", one whose primary importance resides in its great pragmatic value. In general, every mathematical structure--no matter how abstract when initially conceived--eventually becomes involved in the processes or solution of some real world problem. For example, the geometric structure known as Hyperbolic Geometry, or Lobachevskian Geometry, was rejected as impractical by Karl Frederick Gauss, one of history's greatest mathematicians. Yet, not many decades later, Albert Einstein is said to have put the mathematics to work in solving the theoretical and very real physical problems encountered in The Manhattan Project of World War II. The

success of the project in the development of techniques for fission of the atom eloquently endorse both the validity of the mathematics and its sponsor, Dr. Einstein. The great majority of the population perceives mathematics in this role, and the motivation for learning mathematics derives from its ultimate applicability to quantifying, describing, and representing the relationships observed and measured in the physical universe. This pragmatic role is the one in which mathematics can be best interrelated with other disciplines in developing a viable program of environmental education.

At every turn the student, the scientist, and researcher are faced with raw data accumulated at a myriad of sources. This data must be measured, classified, organized, and interpreted before any meaning can be gleaned from it. Factual information collected in scientific analyses must be organized and presented to the lay public and to legislative and governmental agencies. Projections and predictions of trends and patterns need to be developed and explained clearly and concisely. Individuals working in the environmental sciences and in related fields need to understand the

mathematical structures and models they use in their work in order to be able to select and apply the most appropriate formula, graph, table, or quantification for their purposes. Lay citizens need to understand the mathematical and statistical applications that appear in every communication medium in an overwhelming and confusing volume. Often the same data are presented by opposing interests in contradicting models, leaving the mathematically unsophisticated reader concerned about the validity of the original data or the creditability of the researcher. For their own protection as well as for the environmental future of our nation, citizens need to achieve a level of mathematical competence which enables them to make rational decisions concerning reported data, projections, and trends. This level of competence involves primarily the familiar structures of the algebra of the real number system and Euclidean geometry along with applications of these structures to computing, graphing, and elementary level statistics.

Environmental education can play a major role in mathematics education in the learning of mathematics as well as in its applications. Teachers of mathematics,

at times, deplore the abstract nature of mathematics. They sometimes find that it is difficult to convince active, inquisitive adolescents that the structure of elementary algebra is relevant to their conception of the "Real World", for example. Universally, mathematics teachers search for activities and applications of mathematics that will provide motivation to students to want to learn mathematics. The observation that they will need mathematics at some remote future time is usually inadequate. Modern young people are rather present oriented--the so called "now generation". They are, consequently, more aware than any previous generation of the physical environment in which we live. They read about, discuss, and are concerned with the pollution of our planet's water and air resources; and the reckless abandon with which we have squandered our natural supplies of timber and wildlife. Certainly, interdisciplinary projects centered about environmental education can serve the mathematics teacher well. Students can be involved in activities which require the knowledge and use of mathematics along with skills and concepts usually learned in, or associated with,

other disciplines. This strategy is valuable not only for the motivation it can generate within a student of mathematics, but also for the relevant applications he finds for the mathematical structures which he has studied independently of their pragmatic value. Often his limit in scientific exploration will be dictated only by the limit of his knowledge of the mathematical model needed to interpret his findings. Another point supporting the role of mathematics in interdisciplinary environmental education is that of the availability of appropriate activities for virtually any level of mathematical sophistication, utilizing mathematical concepts and skills from pre-school onward. Any student at any age and with any background in mathematics can be, with judicious choices and careful planning, involved in studies which both motivate his interest in mathematics and extend his understanding of his environment.

Mathematics teachers can not be expected, however, to embark on an interdisciplinary program of environmental education without help from many quarters. University educators, supervisors, authors, and environmental scientists need to be enlisted to work for and with teachers. Content units and outlines need to be developed, sample lessons planned, workshops and inservice

training programs offered. Only with this kind of support can we expect to implement fully the goals set in Florida's Master Plan for Environmental Education.

# THE SOCIAL STUDIES COMPONENT OF INTERDISCIPLINARY ENVIRONMENTAL EDUCATION

A Strategy Paper

Irene R. Clark

Elementary Education Department

FLORIDA AGRICULTURAL AND MECHANICAL UNIVERSITY

Tallahassee, Florida

# THE SOCIAL STUDIES COMPONENT OF INTERDISCIPLINARY ENVIRONMENTAL EDUCATION

A Strategy Paper by Irene R. Clark

A comprehensive definition of environmental education which reflects the consensus of all of those who have made major contributions to this interdisciplinary area is elusive. However, the following statements from the Environmental Education Handbook (Public Law 91-516) will serve as a two-part working definition for the benefit of this strategy paper.

> Environmental education is the process that fosters greater understanding of society's environmental problems and also the processes of environmental problem-solving and decision-making. This is accomplished by teaching the ecological relationships and principles that underlie these problems and by showing the nature of the possible alternative approaches and solutions...
>
> It is the educational process dealing with man's relationship with his natural and man-made surroundings, and includes the relation of population, pollution, resource allocation and depletion, conservation, transportation, technology, and urban and rural planning to the total human environment.

This statement represents a large order, and has several implications worthy of discussion as it relates to an environmental education curriculum. Among the implications are:

1. The statement reveals that environmental education

cannot be a single discipline. It is not only multi-disciplinary, but it is also interdisciplinary incorporating materials from the natural sciences and the social sciences. However, environmental education is not a new subject that must be added to the present curriculum but rather an "umbrella" under which all the disciplines can be gathered and thus interrelated.

2. It involves process and theory as well as content and purposes as students physically and intellectually explore their environment for questions as well as answers.

3. It is concerned with values, skills, and attitudes. If an important "root cause" of our environmental crisis is the life styles of our people, then schools should be concerned with the development of values, beliefs, and attitudes that are compatible with man living harmoniously and responsibly with his environment.

Although the definition represents what seems to be an overwhelming scope and task, its achievement is closely related to the attainment of what many have considered to be the particular aims of the social studies.

Before outlining these aims, it seems appropriate to distinguish between the terms "social studies" and "social sciences". The social sciences are the organized, scholarly

bodies of knowledge that deal with human relationships. They are concerned with research, discovery, and experimentation involving groups and institutions. On the other hand, social studies refer primarily to materials for instructional purposes. It is the collective name for the instructional materials and learning activities concerned with human relationships. The social studies are basically therefore elementary and secondary school subjects concentrating on the complexities of human relationships with other humans, with institutions, with the earth and with goods or resources. The social studies program of instruction is grounded in the social sciences. Cultural geography, history, economics, sociology, political science, and anthropology are the main sources of content.

Traditionally, the social studies method of study involved mainly the reading of textbooks and the memorizing of test answers which were quickly forgotten soon after the test was over. Undue emphasis was placed on factually "hop-scotching" from country to country with limited activities. Those activities in which children did participate usually centered around drawing maps and occasionally studying globes. For the most part, cognitive skill development and problem-solving activities were lacking.

The so-called new social studies movement is problem-oriented, concerned with controversy, with values, with affect,

with social and personal decision-making and choices and with their consequences over time. The "new" social studies emphasize the learning of problem-solving skills used in obtaining and handling knowledge, attitudes (values, appreciations, ideals), as well as the understanding of concepts, generalizations, and selected facts. The all important problem-solving aspect may essentially involve children in activities or encounters in which they:

1. Recognize and define selected problems or issues
2. Become informed about the problem or issue, not only through reading but through active involvement in appropriate investigations, etc.
3. Identify and state alternative solutions to be used in decision-making
4. Choose alternative(s) involving information and values and develop a plan of action based on that choice
5. Implement and evaluate the plan of action.

The "new" trend is also toward using the environment itself, using community resources, and expanded community involment to teach youngsters what they need to know about the social studies rather than confining students and teachers within four walls of a classroom.

Aims of the Social Studies

What follows is a list of social studies aims made at a 1968 conference conducted by Educational Development Center

in Mombasa, Kenya and which basically reflect the values of social studies educators internationally:

1. To create an awareness and an understanding of the evolving social and physical environment as a whole, its natural, man-made cultural and spiritual resources, together with the rational use and conservation of these resources for development;

2. To develop a capacity to learn and to acquire skills, including not only the basic skills of listening, speaking, reading and writing, and of calculation, but also the skills of hand, together with the skills of observation, analysis and inference which are essential to the forming of sound judgment;

3. To ensure the acquisition of that relevant knowledge which is an essential prerequisite to personal development as well as to a positive personal contribution to the betterment of mankind;

4. Finally, it is of the utmost importance to develop a sympathetic appreciation of the diversity and interdependence of all the members of the local community, and of the wider national and international community.

Using these statements of definitions and aims as a baseline, what are some of the contributions that the social studies may make to environmental education and what are some concomitant contributions that environmental education may make to the social studies?

Contributions of the Social Studies to the Goals of Environmental Education

The inclusion of the social studies as a component of the interdisciplinary approach to environmental education is based, in part, on the assumption that environmental concern is affected by the dominant institutions and beliefs of a culture

(and likewise the state of the environment in turn affects the culture). The sociological term "culture" is used here to refer to the whole matrix of political, economic, social, and religious institutions as well as to the beliefs, ideas, and ideals that guide a people in their private and public endeavors.

There are few anthropologists today who would disagree with the general statement that environment is an important conditioner of culture. But in some detailed studies, it can be seen that areas that seem similar geographically may differ greatly culturally. Forde (1934) expressed the conclusion in light of this latter situation as follows:

> Physical conditions enter intimately into every cultural development and pattern, not excluding the most abstract and non-material; they enter not as determinants, however, but as one category of the raw materials of cultural elaboration. The study of the relations between cultural patterns and physical conditions is of the greatest importance for an understanding of human society, but it cannot be undertaken in terms of simple geographical controls alleged to be identifiable on sight. It must proceed inductively from the minute analysis of each actual society.

Given the traditional conception of environment, this statement by Forde seems to be more in keeping with present day thinking. Therefore, if all sides of the environmental problem are to be understood, the learner must have an understanding and see the importance of integrating social studies information with other scientific and technological information when working toward solutions to environmental problems.

The social studies make many direct contributions to the development of thinking abilities as decision-making, critical thinking, and creative thinking processes are put to use in many interdisciplinary environmental education units of instruction. The social studies provide the student with the opportunity to apply decision-making processes to his environment and the related problems. Decision-making and problem-solving involve the complex interplay of fundamental skills of the social studies which are essential if we are to deal effectively with real environmental problems.

Obviously, decision-making and the art of valuing are inseparable. Decision-making is always a matter of weighing alternatives and consequences, and this requires practice in recognizing the values behind the choices made. In other words, being able to choose among options and their ultimate effects involves development and assertion of personal values. Admittedly, teachers are usually so engrossed in a web of value judgements that they cannot help but pass some values on to children. However, appropriate values and appreciations should evolve while children are engaged in a variety of learning activities, and these values should not result solely from indoctrination by the teacher or authoritative sources such as textbooks. Deliberate value questioning should be planned by the teacher and should occur during discussion periods.

Also, during investigations and other activity-oriented encounters, children should be encouraged to recognize and to express their values, appreciations, and choices along with possible reasons for these feelings and/or choices. Value clarification may evolve through spontaneous role-playing activities, simulation games, as well as through directly questioning children on their values as they relate to the issues at hand. These activities can, of course, be best carried out and fostered in an atmosphere where the teacher encourages a free exchange of ideas and feelings.

In addition to the basic decision-making skills and the value systems involved, there are other social studies skills which can be effectively utilized in the environmental education program. Aside from their traditional usage; maps, globes, and atlases of various types can be readily employed in problem-solving situations to secure geographical information such as:

1. To locate places in the community, nation, other lands; resources; seaports; centers of population; etc.
2. To compare selected regions, countries, continents with reference to areas, resources, populations, climate, elevation, crops, etc.
3. To make maps of environmental study trips taken by the class; to make maps of neighborhood, schoolyard, community, resources and other items being studied in environmental education units.

4. To use and/or construct pictorial maps on food production, resources, plant and animal life, historical events, etc. which relate to environmental education.

5. To study maps to discover relationships and to make inferences regarding climate and living conditions, industries and resources, vegetation, etc.

As a specific example, the study of the proposed Trans Alaskan Pipeline along with its anticipated ecological problems and concerns can involve map study and many of the aims listed above. If a special effort is made to have children use maps and globes along with other audio-visual aids, they should grow in their ability to use many information sources to solve problems and to answer questions.

In environmental education, students can be taught the economics concepts of trading-off and balancing, using current examples in conservation. Trading-off is a process where one asks what he must give up in order to get what he wants. A current example of this is the trade-offs (such as cleaner air) involved in the continued use of coal until sufficient oil fields or other energy sources can be discovered as solutions to the energy crisis.

Balancing is the process where we look at what happens when we have too much or too little of something. The examples to illustrate this concept are limitless.

In an environmental education course which is problem-oriented, the historical area of the social studies is most beneficial. As in every critical period, peoples of the world are searching for answers to their persistent and evolving environmental problems as well as clues to consequences of alternative solutions. When persons having different points of view come into conflict about the solution to these problems, each person is likely to appeal to the past for support of his own position. This necessitates a study of history, for any present situation is in part a result of the past.

History can do at least two things: it can show what historical ingredients (such as values) have gone into present crises, beliefs, and practices; and what problems face us when inherited traditions confront new conditions and new demands. The role of the historian is not just that of a chronicler of the environmental quality movement, but he is also inextricably linked with the development of our value systems. By our sets of values, we determine what we want to preserve in our environment and our heritage.

A study of history can also show how other peoples in other times have solved or succumbed to similar (though not identical) problems. Indeed, to some extent, most decisions in environmental improvement depend upon an interpretation of history.

Civic responsibility is given direct attention in the social studies. The acceptance and discharge of responsibilities for environmental quality by the children themselves at home and in the community are first considerations. Also basic to civic responsibility are concepts and appreciations directed at the relationship of the individual citizen (with his individual needs, rights and drives) to the larger society (with its needs and requirements.)

Children can and must become aware of the principles behind and the roles which they can play in both individual and group efforts to improve the environment and conserve depleable resources. They may become aware of the importances of simple acts such as cutting off unneeded lights. They may become aware of the importance of encouraging parents to collectively vote and act in an environmentally sound manner on such issues as whether or not our communities will continue to be polluted by such products as high-phosphate detergents and DDT-containing pesticides. Children can and must develop an ecological conscience toward the environment which reflects a commitment of individual and group responsibility to present and future generations.

Among the social scientists, the political scientist now has one of the more important roles in relation to environmental quality. Today, new federal and state laws are rapidly

establishing standards of quality for our air and water, and providing the legal means for acheiving and enforcing those standards. Students may be encouraged to find out the significance and implications of such legislations as the Clean Air Act (1958 and 1972) and the National Environmental Policy Act (1970), as examples. Students may report on the roles of the Environmental Protection Agency established in late 1970.

Herein lies just a few of the contributions the social studies can make to an environmental education program. With modifications and ingenuity by the teacher, many more contributions can become evident.

## Contributions of Environmental Education to the Goals of the Social Studies

First and foremost, environmental education serves as an "umbrella" under which the social studies is linked to and intertwined with other disciplines such as science, mathematics and other areas which relate most closely to the environment.

Within environmental education lies an unsurpassed opportunity and responsibility for social studies teachers to develop an overriding concern for dealing with environmental crises so that this and succeeding generations of our young people will demand the best environmental quality that can be provided and maintained by individuals, private enterprise, and government.

Environmental education presents opportunities to breathe meaning and reality into such social studies concepts as: interdependence, stewardship, change and the processes of change, supply and demand, communities, and others too numerous to mention. It presents opportunities for social studies teachers to focus upon environmental problems as a means of moving outward from the classroom environment, of dealing with physical and cultural realities as well as social and economic. For example, through environmental education, the teacher will be able to provide meaning to such understandings as these: the reality of scarcity so that there is a need to achieve a balance between resources and want; the relationship between personal values and demands and decisions we make about resource use; how the structure of our economic system (with its market allocation process) affects resource use; and an understanding of economic institutions through which activities and decisions affecting the environment can be carried out.

Using information from many discipline areas including the social sciences, most environmental issues involve a blending of theory and pragmatism for solutions; of personal and civic responsibility and skills; of idealism and materialism; of growth and stability. This seems to be what life is all about and these are some of the vital opportunities and responsibilities for the social studies teacher who elevates environmental education to a more significant place in the curriculum.